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No 1

DESCRIPTION

OF THE

NEW AND IMPROVED

HOT AIR

TUBULAR FURNACE,

FOR HEATING

PRIVATE & PUBLIC

BUILDINGS.

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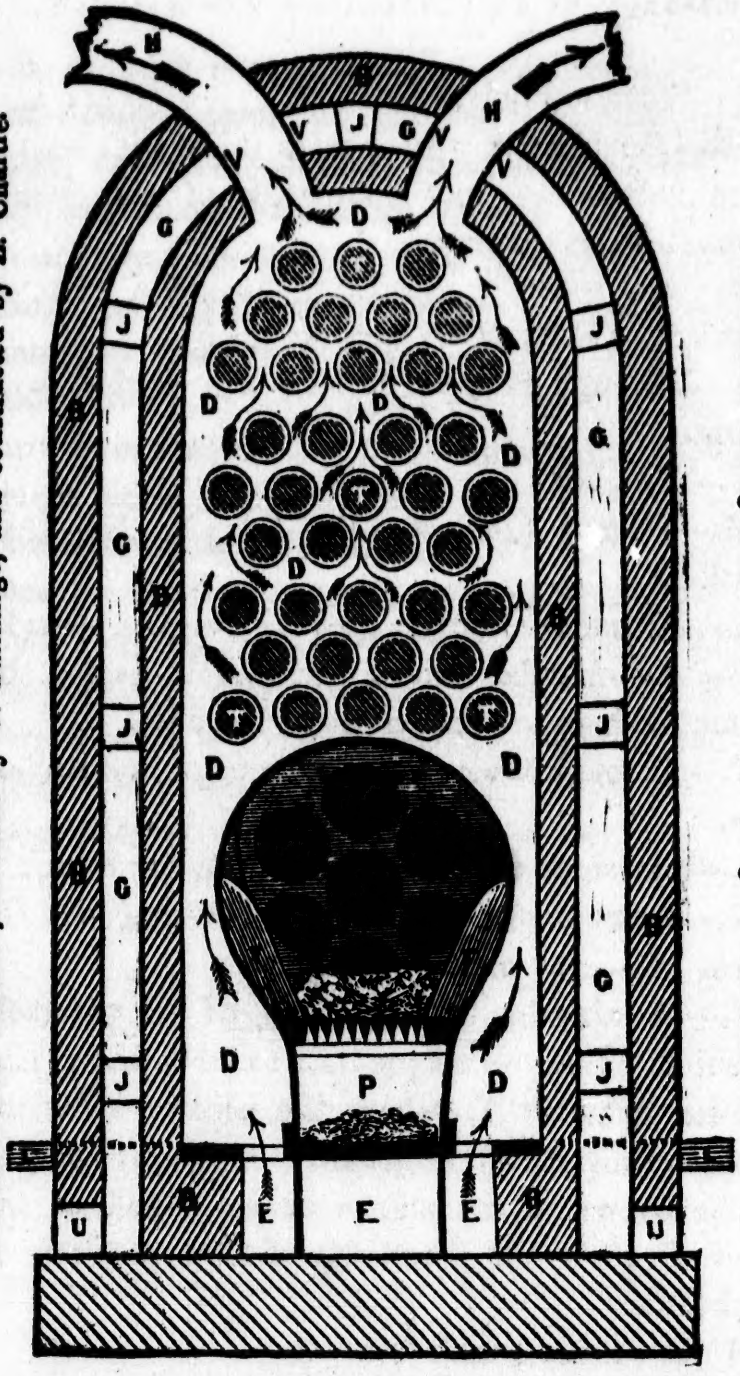


Hot Air Tublar Furnace, invented by C. Baillairgé, and constructed by Z. Chartré.

Cross Section through the Fire Box and through Tubes above it.

References to letters on the diagram.

A—Stone or brick foundation.

B.—Double brick wall ½ brick thick with hollow space between G—for circulation of air which enters through the holes.

O.—And when warmed communicates with the hot air flues H by small perforations R.

J.—Through headers to bind the double brick casing.

F.—Fire box.

M.—Door to fire box. P.—Ash pit. N.—Door to ash pit.

E.—Entrance channels for pure air from outside.

D.—Air chamber where the air is heated by contact with and radiation from the tubes.

T.—Through which the products of combustion pass.

I.—soap stone or fire brick lining to fire box.

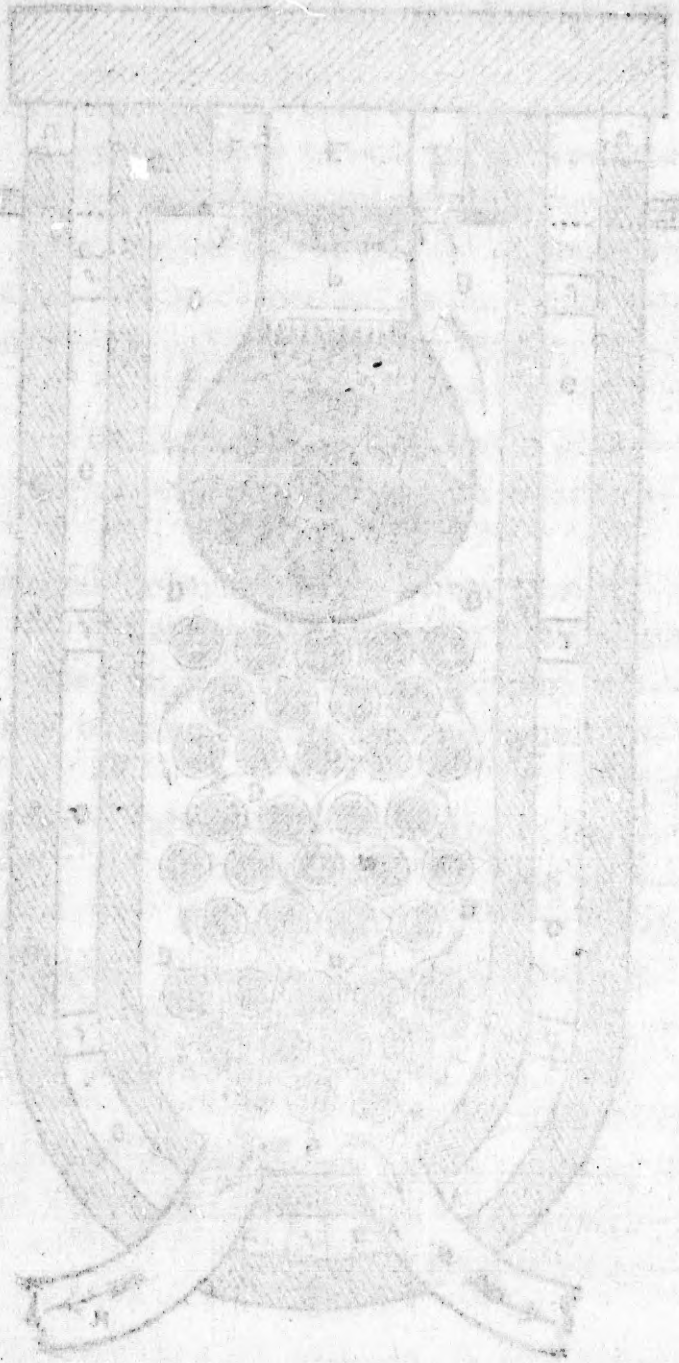
K.—Front smoke box door for cleaning out the tubes. C.—rear smoke box doors.

V.—Openings in the top plate of air channels for sub-dividing the air previous to its entrance into the air chamber D where the arrows show its direct vertical direction towards the hot air flues H.

The arrows in the smoke boxes S and in the tubes T show the direction of the products of combustion.

N. B.—Scale ½ inch to a foot.

Cross Section through the Fire Box and through Tubes above it.



IMPROVED

HOT AIR TUBULAR FURNACE.

THE INVENTOR of the *Hot Air Tubular Furnace*, of which a Model and Plan are here exhibited; being well acquainted with the construction and mode of action, of all the principal Hot Air Furnaces heretofore invented, and put to practical test; and considering them all deficient in point of economy of fuel, and difficult to manage by ordinary servants in dwelling houses—has resolved upon submitting to public attention what he considers to be a decided improvement upon every thing in the same way yet presented. The above mentioned deficiency in economy, of all now existing Hot Ait Furnaces, depends mainly upon the very small amount of surface they present for cooling down the gaseous products of combustion before they reach and enter the chimney; the best and most ordinary proof of which, is, that a stove with a gallows or three

branch pipe emits almost double the amount of heat of one with a single pipe, and that most evidently—on account of the greater amount of surface in the former as compared with the latter.

The difficulty of managing them consists in the almost total impossibility of cleansing out the soot or condensed smoke from the flues, on account of their numerous bends and turnings, and in the want of necessary intelligence and attention on the part of servants for working the short and long draught dampers in furnaces where the smoke takes a downward course, and without which precaution a room full of smoke must necessarily issue from the feed door every time it is opened to put on new fuel.

There is no good reason why the best form of furnace and boiler for heating water and producing steam, should not also be that best adapted to heating air—for the object sought to be attained in steam boilers has always been and is still to provide enough fire box and flue surface to absorb all the heat from the products of combustion before their reaching the chimney.

Such has also been the *inventor's* object in the *Tubular Hot Air Furnace* which contains no less than 300 superficial feet of heating surface, whereas

most of the furnaces now made use of contain no more than from 50 to 100 feet of do.

An inspection of the model here presented will make it obvious to the most superficial observer, that the possibility of thoroughly reaching and cleansing out every part of the fire box, smoke flues and smoke boxes, is most amply and easily provided for, without the necessity of taking to pieces any part of the apparatus. By opening the fire box door and the front smoke box doors every tube in the apparatus is brought to view; and small doors are provided in the rear smoke boxes for removing whatever soot might fall into them while cleansing out the tubes.

The direction of the arrows both on the model and on the accompanying plan and the red tint plainly show the direct course of the smoke from the fire box to the chimney; its passage being horizontal through the tubes and vertical through the smoke boxes alternately.

A short draught is provided between the upper and lower front smoke boxes by which, according to requirements, the distance to be travelled by the smoke may be more than half diminished, and the amount of heating surface proportionally lessened.

It will be observed that the fresh and pure air from without the bnilding is brought in under the furnace and sub-divided by separate channels in such a way as to envelope in its ascent every part of the fire box and flues. Whereas in almost all other furnaces now used the air enters at one side only and directly begins to ascend, thereby only coming in contact with about half the heating surface.

The inventor claims as a most marked improvement the sub-division of the air, (first by separate entrance channels and then by the small distances between the tubes themselves, between the tubes and outer casing, and between the smoke boxes and outer casing) into thin vertical strata; for by such a subdivision it is much more rapidly heated by being at every point in contact with heating surfaces, than what a large undivided bulk of air is which receives its heat merely from radiation.

The arrows, in the blue tint on the plan, show the direct vertical motion of the air, through the apparatus, from the bottom at which it enters, to the top of the air chamber where it divides into separate channels on its way to the apartments to be supplied with it.

It will no v be evident, on account of the above mentioned sub-division of the air, and its contact at every point with the heating surface, aided by its almost perfectly vertical motion from its entrance into the air chamber, to its exit therefrom, that a very large amount of it may be heated in a very small space of time, and an uninterrupted current kept up, sufficient to supply a large number of apartments, thereby subserving the purposes of the most complete ventilation, when exhaust tubes are provided for taking it off as soon as vitiated by respiration or other causes.

The *inventor* has not aimed at producing a model of a theoretically perfect heating apparatus, but of one which he is confident, will be as near as possible perfect in practice. He is well aware that it would be an advantage for the furnace to consume its own smoke, and thereby carry economy to its utmost limit; the direction of the smoke also should be downwards for the purpose of bringing the cooler air as it enters the air chamber in contact with the coolest part of the smoke flue making its exit from the same into the chimney; for when the direction of the smoke is upwards, it may be true, to a certain extent, that the cool smoke on its way to the

chimney robs the hot air at the chamber top of part of its heat. The disadvantages in practice however, and difficulty of creating and maintaining a downward draught through the smoke flue, do more than counterbalance any advantage to be gained by the desired arrangement; for even when the necessary dampers are opened previous to a new supply of fuel, it still takes a considerable space of time for the smoke to abandon its wonted course and resume a new one, and during the interval there is certainty of the emission of smoke in large quantities from the feed door. In furnaces where the smoke takes a downward direction it is difficult and almost impossible to kindle a fire at the first outset, unless a small fire be previously kindled in the chimney shaft to exhaust the air from the flues and thereby create the required draught through them, and ordinary servants in dwelling houses will always prefer the disadvantage of a room full of smoke to the trouble of working dampers and kindling a first fire by which to procure a draught for the second. To be sure in many chimnies there is a sufficient natural draught but that is the exception and not the rule.

It is obviously necessary also for smoke consuming

purposes, that it (the smoke) should be made to pass through a stratum of red hot coke or pumice stone; but the draught becomes so much impeded in practice, by having to pass through any such stratum, that what might be gained in economy of fuel by robbing the smoke of all its carbon, etc., is otherwise more than compensated for by the diminished draught of the fire, and the cost of maintaining a stratum of coke or pumice stone by a jet of gas or other means in a state of incandescence. The consuming of the smoke is sometimes sought to be attained by causing it to pass directly downwards through the fuel on the fire grate; but in practice the grate bars become so much clogged by the fuel especially when bituminous coals are used or wood that the draught becomes injuriously diminished—and in case of the least joint in the fire box or flues not being air tight the smoke will ooze through it into the air chamber and thence into the apartments to be supplied; for it is evident that if any such joint (not air tight) exist and if the draught in the smoke flues is less than that in the air chamber, the smoke will seek a passage through the latter. Another consideration is that with a downward current in the smoke flue, the cold air at the bottom of

the furnace impinging upon and surrounding it must necessarily condense the unconsumed particles of carbon &c., which the smoke contains and cause the flue to become foul in a short space of time, thereby necessitating frequent cleansing out of the soot, and creating impedement to the draught.

Facility of construction has been aimed at in the present improved form of heating apparatus and it will be seen upon inspecting the model, after removing its outer casing of brickwork, that the whole is easy to model and cast and easy to put together. The fire box and smoke boxes and the first or lower series of tubes are to be cast iron ; the remaining tubes—wrought iron, to be made air tight at their junctions with the end plates by the forcible insertion of wrought iron collars into their extremities causing them to expand at those points and form a perfect junction.

Cast iron however is in the present case made use of for the smoke boxes, merely as being more economical in point of expense on account of the greater facility and diminished cost of construction—and it is made use of for the fire box and first row of flues as being better able to withstand for a longer period of time the force of the fire.—Nothing however,

should prevent the whole apparatus being made of boiler plate, as by that means, the joints being all riveted and calked would be more certainly air tight than would be cast iron plates with cement and sand joints, &c.

The inside of the fire box to a certain height to be lined with fire bricks or soap stone, thereby preventing the air from being brought into contact with any red hot surface which would probably rob it of part of its oxygen or life sustaining qualities.

One furnace on the present improved system is adequate to warming any ordinary sized house of three or four stories with basement and attics: for a smaller house and one with a very low basement story it would evidently be an easy matter to lower the height of the apparatus and diminish its heating surface by the suppression of one or two series of tubes, which would cause but a very trifling alteration in the models used to cast the front and rear smoke boxes and not the least alteration in any other part of the apparatus.

For a house of larger dimensions two or three furnaces should be built within one brick vault—the advantage of the arrangement being that a fire might be lighted in one or more of them in pro-

portion to the increasing cold from one season to another, and the same bulk of air made either luke warm or of a much higher temparature according to requirements.

The *inventor* has already erected several hot air furnaces according to his own plans, different in each case, for the sake of practical experiment, and at each successive trial it was found advantageous to approach more and more to the present improved form of the *hot air tubular furnace.*

The *inventor* is also engaged at the present moment in erecting his improved heating apqaratus in several private and public buildings in the district of Quebec (Canada East) where, as is well known, on account of the severe cold of winter, an economical and easy mode of heating is more desirable than elsewhere because of the great cost and increasing scarcity of fuel.

In conclusion of these explanatory remarks, the *inventor* would recall the fact that the great defect of all the now existing furnaces is their want of surface to absorb the heat from the products of combustion before they reach the chimney, and so true is this statement that in almost all of them the smoke enters the chimney flue at from 300° to 400°

farenheit instead of 60° F. which is all that is requisite for causing a good draught.

In conection with the proposed mode of heating buildings, the *inventor* is carrying out the most complete system of ventilation ever put to practical test. A detailed account of the system would be inconsistent with the object of this pamphlet—referring merely as it does to the mode of heating, but a few words may not be out of place, especially, when it is considered, that no scheme for heating buildings can be well carried out without ventilation, since it is physically impossible to force pure warm air into any apartment of which the doors and windows are closed, without at the same time removing therefrom byv entilating tubes the impure and vitiated air which the room contains. Each apartment is to be provided with at least three registers and tubes or flues, one near the bottom of the room for the admission of pure warm air from the furnace, another at the the opposite side of the apartment and near the top for the escape of the vitiated air, and another near the bottom of the room for the admission of pure fresh air directly from without. All the fresh air flues unite in the roof into a single flue of larger dimensions to the top of which is fixed one of

Emersons or Mots' injecting cowls. All the foul air flues unite in the same way into a single one of proportional dimensions and with an ejecting cowl at top, but to help the draught through the foul air flues ; a branch pipe is inserted above their point of junction and carried to the nearest chimney flue. It is evident then that a constant draught will be maintained in the foul air flues which will exhaust from the ventilated apartment its vitiated air and cause a corresponding influx of pure fresh air from outside or of pure warm air from the furnace according as the register of one or the other is opened. The chimney flue would create a draught through the foul air flues whenever a fire would be burning in the former, and in case of no fire in the chimney the action of the wind on the ejecting cowl would cause the required draught ; but by fixing an ejecting cowl to the chimney flue also they might both act in conjunction and with double effect.

In the heat of summer however—when ventilation is most wanted, and especially in bed rooms during the night—there would probably not be one fire burning in the whole building ; then again there might not be even the slightest breeze of wind to

create a current through the ejecting cowls, in the absence of all of which it becomes indispensable to provide some means for creating the required draught through the foul air flues and the consequent abstraction of vitiated air from the apartments.

To obtain the desired effect a fanner may be used worked by water or other power, or it may be produced by the means of heat from a small fire in the foot of the ventilating shaft or from a group of gas burners, according as one process or the other is more or less expensive or dangerous. In very large appartments, with comparatively few inmates, it would be good to introduce a separate flue and register by which the still pure air might be returned to the air chamber of the furnace to receive an accession of heat and then be returned into the apartment. The exhausting process would be carried still further by placing near the floor of any apartment a register and tube by which the cold air and carbonic acid gases might be taken into the fire box and thence passed through the flues to the chimney.